(76)

A TURBO-CHARGED INTERNAL COMBUSTION ENGINE

The present invention relates to a turbo-charged internal combustion engine.

It is a technical problem to provide a turbo-charged engine which makes effective use of turbo-charging over a large range of engine speeds and loads. It is desirable to provide an engine with a simple way of controlling the amount of turbo-charged air delivered to a combustion chamber and also the degree of swirl and/or tumble motion imparted to the air on delivery.

The present invention provides an internal combustion engine comprising:

a combustion chamber;

first and second inlet valves controlling flow of air into the combustion chamber;

first and second exhaust valves controlling flow of combusted gases out of the combustion chamber; and

first and second turbo-chargers; wherein:

the first turbo-charger is connected to the first inlet valve and the second turbo-charger is connected to the second inlet valve;

charge air supplied to the combustion chamber via the first inlet valve is pressurised only by first turbo-charger;

charge air supplied to the combustion chamber via the second inlet valve is pressurised only by the second turbo-charger;

the first turbo-charger is connected to the first exhaust valve and receives only combusted gases expelled via the first exhaust valve;

the second turbo-charger is connected to the second exhaust valve and all combusted gases expelled via the second exhaust valve flow to the second turbo-charger without passing through the first turbo-charger;

valve operating means controls operation of the first inlet valve and first exhaust valve independently from the operation of the second inlet valve and second exhaust valve thereby providing variation in the ratio of the mass of charge air supplied to the combustion chamber via the first inlet valve to the mass of charge air supplied to the combustion chamber via the second inlet valve; and

the valve operating means is controlled by an electrical controller to vary operation of the inlet and exhaust valves and thereby the turbo-chargers having regard to changes in engine operating conditions, the controller being able to select between different modes of operations, including:

a first operating mode in which the valve operating means deactivates the second inlet valve and the second exhaust valve whereby all charge air supplied to the combustion chamber is pressurised by the first turbo-charger and delivered via the first inlet valve; and

a second operating mode in which the valve operating means operates simultaneously the first and second inlet valves and the first and second exhaust valves whereby charge air supplied to the combustion chamber is pressurised by both of the first and second turbo-chargers and delivered via both the first and second inlet valves;

characterised in that:

the controller can also select a third operating mode in which the valve operating means deactivates the first inlet valve and the first exhaust valve whereby all charge air supplied to the combustion chamber is pressurised by the second turbo-charger and delivered via the second inlet valve.

Preferred embodiments of the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 is a schematic illustration of a first embodiment of a turbo-charged internal combustion engine according to the present invention; and

Figure 2 is a schematic illustration of a second embodiment of a turbo-charged internal combustion engine according to the present invention.

In figure 1 there can be seen a single cylinder engine with a cylinder 10 having two inlet valves 11,12 and two exhaust valves 13,14. Each of the inlet valves 11,12 and exhaust valves 13,14 is operated by a valve operating mechanism which allows the respective valve to be deactivated.

The valve operating mechanism could be a cam profile switching mechanism, perhaps operated in conjunction with a cam phasing mechanism. Alternatively (and preferably) the valve operating mechanism comprises an actuator (e.g. an electrically-controlled hydraulic actuator) for each valve.